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# GENETIC STUDIES ON YIELD ATTRIBUTING TRAITS IN INDUCED POPULATION OF WHEAT (*TRITICUM AESTIVAM* L.) OF $M_2$ GENERATION

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***ABSTRACT***

***The current study investigated genetic studies on Yield Attributes Traits viz. days to heading, days to flowering, days to maturity, plant height, number of effective tillers/plant, grains/spike, 100 seed weight and seed yield/plant of mutant wheat in the during Rabi 2010-13 at Central Research Field, Department of Genetics and Plant Breeding, SHIATS, Allahabad, India. Dry seeds of wheat var. K-7903, were irradiated with 00 kR, 05 kR, 10 kR, 15 kR, 20 kR, 25 kR, 30 kR, 35 kR, 40 kR and pre-soaked seeds 00 kR, 05 kR, 10 kR, 15 kR, 20 kR by a $^{60}$Co - gamma chamber at National Botanical Research Institute, Lucknow, India. The study revealed that gamma irradiation significantly affected all the mentioned traits. The value of genotypic coefficient of variance (GCV) for different qualitative traits were observed ranged from 40kR dry (0.32) to 30kR dry (11.12) and Phenotypic Coefficient of Variance (PCV) was obtained ranged from 1.23 (10kR dry) to 26.00 (40kR dry). The seed yield/plant exhibited maximum GCV (13.86) and PCV (14.61).The maximum heritability (broad sense) and genetic advance was recorded under 15kR dry of no. of effective tillers/plant (46.37, 2.55) respectively, as compared to another treatment in the $M_2$ generation. The no. of effective tillers/plant showed that maximum heritability (broad sense) (90.06) whereas, the plot stand showed that maximum genetic advance (17.45). High values of heritability and genetic advance indicate the possibility of inducing desirable mutations for polygenic traits accompanied by effective selection in $M_2$ and later generations. The study indicated that not gamma rays doses are equally effective in generating variability for qualitative traits.***

***KEYWORDS:* wheat, gamma rays, heritability, genetic advance, $M_2$ generation**

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**Original Article**

## INTRODUCTION

History of wheat (*Triticum aestivum* L.*)* improvement by acclimatization, selection and hybridization dates back to the remote past, but with the passage of time these methods were found to be unsatisfactory because of the limited genetic variation among the existing wheat population. The early research work of Muller (1927) and Stadler (1928) however, opened a new era in the field of plant improvement. Therefore, the plant breeders and geneticists of the 20th century were inclined to radiation as a new tool for plant improvement. Nowadays, mutation induction has become an established tool in plant breeding to supplement existing germplasm, and to improve cultivars in certain specific traits. Effects of gamma rays on quantitative and qualitative characteristics of rice indicated that radiation dose some what improved growth characteristics, but with increasing dose rate, a decreasing trend is observed in the studiedtraits (Saha *et al.*, 2005).

## MATERIALS AND METHODS

This research was conducted in the Rabi 2010-13 growing seasons at Central Research Field, Department of Genetics and Plant Breeding, SHIATS, Allahabad, India. The standard variety of wheat, K-7903 (Halna) were got irradiated each with dry 00 kR, 05 kR, 10 kR, 15 kR, 20 kR, 25 kR, 30 kR, 35 kR, 40 kR and pre-soaked seeds of the same was exposed to 00 kR, 05 kR, 10 kR, 15 kR, 20 kR doses of $CO^{60}$ gamma rays at 2.2 kR per minute intensity from NBRI, Lucknow. The data ware recorded for days to heading, days to flowering, days to maturity, plant height, number of effective tillers/plant, grains/spike, 100 seed weight and seed yield/plant. The experiments were organized in $M_2$ generation a Randomized Family Block Design with 3 replications with the row of 3 meter length with a spacing 25x10 cm.

## RESULTS AND DISCUSSIONS

From table 1 to 2, the value of genotypic coefficient of variance (GCV) for different qualitative characters were observed ranged from 40kR dry (0.32) to 30kR dry (11.12) and Phenotypic Coefficient of Variance (PCV) was obtained ranged from 1.23 (10kR dry) to 26.00 (40kR dry). The seed yield/plant showed that maximum GCV (13.86) and PCV (14.61) followed by no. of effective tillers/plant (13.15, 13.85) and plot stand (9.91, 13.53) respectively.

The maximum heritability (broad sense) was recorded under control presoaked (85.46) whereas, in the case of gamma rays treated seeds the maximum heritability (broad sense) was observed by 15kR dry (46.37) as compared to another treatment whereas, 40kR dry showed minimum heritability (broad sense). The no. of effective tillers/plant (90.06) was depicted maximum heritability (broad sense) followed by seed /yield (89.92) whereas, the minimum heritability (broad sense) was observed under plot sand (53.61). The maximum genetic advance was observed under plot stand (17.45) followed by plant height (6.71). Zaka *et al.*, 2004 studies that the low dose of gamma irradiation stimulates cell division and high-dose inhibits cell division due to free radicals and DNA system damage. High doses of gamma radiation cause DNA damage and expression of genes related to Callus (Patade *et al.,* 2008).

The maximum genetic advance was observed under the control dry (3.65) whereas, in the case of gamma rays treated seeds the 15kR dry (2.55) treatment was observed the the maximum genetic advance. The study indicated that not gamma rays doses are equally effective in generating variability for qualitative traits. Scossiroll (1968) studies increase in variance for several quantitative traits in mutagenised population has been reported in wheat.

The present study concludes that 15 kR dry dose of gamma rays best for the improvement of qualitative traits in wheat compare to another treatment. An effective selection technique based on heritability (broad sense), genetic advance, GCV and PCV shifted useful variability in the desirable direction to $M_2$ generation a large portion of which was heritable.

**Table 1: Estimation of Genetic Variability for Quantitative Treatment Wise**

| Characters | Days to Heading | | | | Days to Flowering | | | | Days to Maturity | | | | Plant Height | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GCV | PCV | $h^2$ | GA | GCV | PCV | $h^2$ | GA | GCV | PCV | $h^2$ | GA | GCV | PCV | $h^2$ | GA |
| Control | 1.17 | 1.35 | 75.87 | 1.71 | 1.51 | 1.79 | 71.21 | 2.33 | 1.71 | 1.99 | 74.22 | 3.65 | 1.85 | 2.14 | 75.02 | 2.75 |
| 05 kR(dry) | 1.36 | 2.43 | 31.17 | 1.29 | 1.09 | 2.14 | 26.22 | 1.03 | 1.11 | 2.36 | 22.09 | 1.31 | 1.66 | 3.68 | 20.27 | 1.31 |
| 10 kR " | 1.08 | 2.04 | 28.01 | 0.94 | 0.93 | 2.64 | 12.23 | 0.59 | 1.01 | 2.39 | 17.74 | 1.05 | 1.35 | 3.43 | 15.44 | 0.93 |
| 15 kR " | 2.98 | 5.86 | 25.83 | 0.08 | 0.73 | 1.30 | 31.80 | 0.76 | 1.40 | 2.64 | 28.05 | 1.83 | 0.76 | 1.68 | 20.24 | 0.58 |
| 20 kR " | 1.49 | 2.85 | 27.18 | 1.27 | 0.90 | 2.40 | 14.18 | 0.61 | 0.82 | 2.48 | 10.88 | 0.47 | 1.19 | 2.55 | 21.82 | 0.97 |
| 25 kR " | 1.07 | 2.72 | 15.52 | 0.72 | 0.78 | 2.90 | 7.17 | 0.39 | 0.87 | 3.42 | 6.51 | 0.56 | 1.28 | 3.02 | 17.93 | 0.93 |
| 30 kR " | 0.82 | 2.48 | 10.88 | 0.47 | 0.60 | 2.86 | 4.40 | 0.24 | 0.69 | 3.14 | 4.88 | 0.39 | 1.23 | 4.16 | 8.81 | 0.61 |
| 35 kR " | 0.82 | 3.19 | 6.58 | 0.37 | 1.53 | 3.08 | 24.84 | 1.43 | 0.65 | 2.34 | 7.69 | 0.46 | 1.03 | 4.57 | 5.08 | 0.37 |
| 40 kR " | 0.11 | 5.31 | 0.05 | 0.01 | 0.69 | 4.15 | 2.78 | 0.22 | 0.32 | 3.11 | 1.05 | 0.09 | 0.32 | 5.11 | 0.40 | 0.03 |
| Wet control | 1.97 | 2.28 | 74.79 | 2.84 | 1.22 | 1.45 | 70.20 | 1.87 | 1.40 | 1.59 | 77.03 | 3.04 | 2.05 | 2.36 | 75.95 | 3.06 |
| 05 kR (Presoaked) | 0.79 | 2.48 | 10.11 | 0.43 | 0.90 | 2.81 | 10.34 | 0.54 | 0.92 | 1.80 | 26.20 | 1.18 | 1.01 | 3.18 | 10.10 | 0.56 |
| 10 kR " | 1.22 | 3.05 | 15.92 | 0.82 | 1.64 | 3.00 | 29.88 | 1.64 | 0.67 | 2.50 | 7.13 | 0.44 | 1.28 | 3.91 | 10.69 | 0.74 |
| 15 kR " | 0.43 | 2.10 | 4.16 | 0.15 | 0.52 | 3.00 | 3.04 | 0.17 | 0.82 | 2.27 | 12.98 | 0.74 | 1.29 | 3.03 | 18.03 | 0.92 |
| 20 kR " | 0.50 | 3.59 | 1.92 | 0.12 | 0.52 | 3.08 | 2.82 | 0.17 | 0.69 | 3.08 | 5.06 | 0.40 | 1.70 | 6.10 | 7.78 | 0.77 |

**Table 2: Estimation of Genetic Variability for Quantitative Traits Treatment Wise**

| Characters | No. of Effective Tillers / Plant | | | | Grains / Spike | | | | 100 Seed Weight | | | | Seed Yield/Plant | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GCV | PCV | $h^2$ | GA | GCV | PCV | $h^2$ | GA | GCV | PCV | $h^2$ | GA | GCV | PCV | $h^2$ | GA |
| Control | 7.60 | 9.73 | 61.08 | 1.11 | 2.57 | 2.95 | 75.74 | 2.38 | 1.33 | 1.44 | 84.52 | 0.09 | 2.68 | 3.22 | 69.14 | 0.82 |
| 05 kR(dry) | 11.85 | 22.08 | 28.78 | 1.21 | 3.21 | 6.37 | 25.49 | 1.72 | 1.09 | 1.97 | 30.37 | 0.05 | 4.03 | 7.91 | 26.03 | 0.76 |
| 10 kR " | 9.10 | 20.62 | 19.47 | 0.82 | 2.14 | 5.31 | 16.30 | 0.92 | 0.58 | 1.29 | 20.63 | 0.02 | 4.47 | 8.73 | 26.23 | 0.88 |
| 15 kR " | 16.42 | 24.12 | 46.37 | 2.55 | 3.09 | 5.46 | 31.97 | 1.95 | 1.32 | 2.40 | 30.22 | 0.06 | 4.81 | 8.92 | 29.02 | 1.12 |
| 20 kR " | 7.35 | 12.82 | 32.82 | 0.89 | 2.87 | 5.18 | 30.57 | 1.72 | 0.83 | 1.69 | 24.14 | 0.03 | 2.94 | 7.42 | 15.69 | 0.45 |
| 25 kR " | 4.85 | 11.74 | 17.11 | 0.40 | 1.82 | 3.40 | 28.67 | 1.05 | 1.54 | 3.04 | 25.63 | 0.06 | 3.58 | 8.96 | 15.98 | 0.55 |
| 30 kR " | 11.12 | 21.55 | 26.64 | 1.04 | 2.28 | 4.52 | 25.33 | 1.20 | 1.88 | 4.55 | 17.11 | 0.06 | 3.14 | 10.95 | 8.21 | 0.30 |
| 35 kR " | 4.52 | 19.15 | 5.57 | 0.17 | 2.19 | 7.13 | 9.47 | 0.69 | 2.63 | 10.48 | 6.30 | 0.05 | 1.74 | 8.85 | 3.88 | 0.11 |
| 40 kR " | 5.04 | 26.00 | 3.76 | 0.12 | 1.88 | 4.86 | 14.99 | 0.74 | 2.39 | 11.10 | 4.64 | 0.03 | 0.82 | 14.20 | 0.33 | 0.01 |
| Wet control | 7.16 | 8.71 | 67.62 | 1.10 | 3.02 | 3.53 | 73.24 | 2.75 | 1.35 | 1.46 | 85.46 | 0.09 | 4.71 | 5.70 | 68.23 | 1.44 |
| 05 kR (Presoaked) | 9.15 | 21.89 | 17.47 | 0.74 | 2.14 | 3.68 | 33.98 | 1.34 | 0.78 | 1.42 | 29.97 | 0.03 | 3.37 | 6.57 | 26.39 | 0.64 |
| 10 kR " | 13.49 | 22.60 | 35.63 | 1.60 | 1.65 | 3.52 | 21.92 | 0.83 | 0.58 | 1.60 | 13.14 | 0.02 | 3.14 | 9.58 | 10.72 | 0.37 |
| 15 kR " | 8.04 | 21.89 | 13.49 | 0.53 | 1.86 | 3.97 | 21.91 | 0.88 | 0.51 | 1.52 | 11.17 | 0.01 | 3.07 | 8.72 | 12.44 | 0.36 |
| 20 kR " | 10.25 | 22.93 | 19.98 | 0.75 | 1.58 | 3.68 | 18.45 | 0.70 | 1.18 | 4.01 | 8.69 | 0.03 | 3.88 | 12.48 | 9.67 | 0.36 |

**Table 3: Estimation of Genetic Variability for Quantitative Traits**

| Characters' | $M_2$ Generation | | | |
|---|---|---|---|---|
| | GCV (%) | PCV (%) | $h^2$ (Broad Sense %) | GA |
| Days to heading | 2.39 | 2.77 | 74.36 | 3.51 |
| Days to flowering | 1.86 | 2.12 | 77.01 | 3.02 |
| Days to maturity | 2.06 | 2.18 | 89.37 | 4.89 |
| Plant height | 4.33 | 4.71 | 84.67 | 6.71 |
| No. of effective tillers / plant | 13.15 | 13.85 | 90.06 | 2.33 |
| Grains / spike | 4.60 | 4.85 | 89.91 | 4.55 |
| Grains per spikelet | 3.84 | 4.36 | 77.66 | 0.18 |
| Plot stand | 9.91 | 13.53 | 53.61 | 17.45 |
| 100 seed weight | 3.64 | 4.00 | 83.20 | 0.25 |
| Seed yield/plant | 13.86 | 14.61 | 89.92 | 4.62 |

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